

Remarks

The present application includes claims 1-21. The 6 May 2004 Office Action rejected all claims (i.e., claims 1-21). Claims 1, 2, 5, 6, 7, 11, 12, 15, 16, 17, 18, 19 and 20 were rejected under 35 U.S.C. 102(e) as being anticipated by Abbot et al. (US Application 2004/0057046 A1). Claims 8-9 were rejected under 35 U.S.C 103(a) as being unpatentable over the Abbot et al. published US application, and claims 3-4, 10, 13, 14, and 21 were rejected under 35 U.S.C. 103(a) as being unpatentable over the Abbot et al. published US application in view of *Fukuhara* (U.S. Patent No. 4,653,316). Accordingly, all claims are rejected over the Abbot et al. published US application, either alone or in combination with *Fukuhara*.

But the Abbot et al. published US application was filed on 28 February 2003, as a continuation-in-part of a PCT application (PCT/US01/27280) filed 30 August 2001. Neither the Abbot et al. published US application nor the PCT application have a filing date prior to the 23 May 2001 filing date of the present application. It is only a provisional application (U.S. serial No. 60/230,281) whose benefit is presumably claimed in the PCT application and the published US application that has an earlier filing date. Accordingly, only the subject matter disclosed in the provisional application is prior art against the present application. No subject matter subsequently added into the PCT application or into the published US application is prior art against the present application because such added subject matter has a later filing date. The following remarks are directed to the Abbot et al. provisional application serial no. 60/230,281, hereinafter referred to as *Abbot-PV*.

Abbot-PV discloses an optical system for imaging distortions in a moving reflective sheet, such as a sheet of glass. The distortions are caused when a heated glass sheet sags between rows of rollers on a roller table on which it is being transported during a tempering process. A light box 15 and a patterned diffuser 17 project a pattern onto the reflective sheet. The pattern can be a set of parallel stripes or an orthogonal pattern of parallel stripes and intersecting lines approximately 25 mm apart. The leading and trailing edges of the stripe are spaced $\frac{1}{4}$ or $\frac{3}{4}$ the length of a glass sheet distortion cycle (or any odd $\frac{1}{4}$ wavelength). Lines may be included parallel to the transmit direction, wherein the resulting stripes and lines form an array of squares measuring about 1 inch by 1 inch. The reflected image is captured by cameras 18. A processor 20 measures distances between leading and trailing edges of the stripe and compares to a prior distance. Maximum and minimum distances are defined and correlated to distortion in the glass.

In a preferred embodiment, the Abbot-PV pattern includes three stripes. The processor checks that a sheet of glass is reflecting all three stripes before taking measurements. This allows the processor to distinguish an actual stripe from the distance between the edge of the glass and a stripe. When all three stripes are being reflected, the processor measures only the center stripe.

Each of applicant's independent claims has been amended herein to specify that the present invention projects a two-dimensional pattern of alternating relatively lighter and darker regions of varying widths upon the surface. This feature is neither taught nor suggested by either Abbot-PV or Fukuhara, either alone or in combination with one another.

The present invention also amends the specification in the paragraph on page 12 starting at line 17 to clarify this amendment to the independent claims and to correct a clerical error. The amendment to the specification and to the claims is not new matter. This "varying width" language merely reflects what Figs. 2-6 clearly show. In addition, this language also restates one inherent characteristic of a group of patterns that have a mathematical autocorrelation function that is high at zero translation (i.e., in the longitudinal direction) and low everywhere else, as stated elsewhere in the specification.

Those skilled in the art will appreciate that autocorrelation is a mathematical tool used frequently in signal processing for analyzing functions or series of values. It is merely the cross-correlation of a signal with itself. As applicant's specification states, a specific pattern is desired that exhibits a high autocorrelation (i.e., cross-correlation with itself) at zero translation (i.e., perfectly aligned with itself) but low correlation otherwise. In order to achieve this characteristic, the relatively lighter and darker regions need to be of varying widths.

Since all of applicant's claims require the varying width feature, and since neither *Abbot-PV* nor *Fukuhara* teach this feature, either alone or in combination with one another, all of applicant's claims are now allowable over the cited prior art. Reconsideration is respectfully requested.

Moreover, this limitation is not a mere design choice. This feature allows an image projected over a large area to be used in forming a surface profile at a specific point. The sharper the autocorrelation characteristic, achieved by the varying widths feature, the better the focus at that specific point. On the

other hand, the use of information projected and reflected from a large area has an integrating effect that makes the present invention unresponsive to spaces between aggregate, and other small-scale anomalies. *Abbot-PV* would be unworkable for its intended purposes if modified to resemble that which applicant claims. The integrating effect resulting from using a variety of stripes of varying widths would tend to wash-out the small-scale distortion that *Abbot-PV* seeks to detect.

Claim 2 is allowable for the above-discussed reasons due to its dependency on claim 1. But another reason exists for finding claim 2 allowable. With respect to claim 2, the Office Action asserted that *Abbot* discloses multiple patterns being projected, captured, and processed substantially simultaneously. These allegations concerning the teaching of *Abbot* may be true for the published US application, but only to the extent that new subject matter was added after *Abbot-PV*. This teaching is absent from *Abbot-PV* and cannot be used as prior art against the present application. Accordingly, independent grounds exist for finding claim 2 allowable.

Claims 3, 4, and 10 are each allowable for the above-discussed reasons due to their dependency on claim 1; claims 13, and 14 are each allowable for the above-discussed reasons due to their dependency on claim 11; and, claim 21 is allowable as discussed above. But other reasons exist for finding claims 3, 4, 10, 13, 14 and 21 allowable. With respect to these claims, the Office Action acknowledges that *Abbot* does not teach the detection of road surfaces, but alleges that *Fukuhara* does and that it would have been obvious to combine the teachings of *Fukuhara* with those of *Abbot*.

Fukuhara teaches the projection of a scanning laser beam onto a road surface substantially perpendicular to the surface of the road. The laser beam is detected by a photomultiplier or like sensor, and the location of cracks in the road are determined. *Fukuhara* teaches neither the measurement of contour or the determination of flatness. What *Fukuhara* does teach is the detection of cracks in a surface by projecting a flying spot onto the surface and monitoring the brightness of its reflection. When the reflection disappears (or is markedly reduced), a crack has been encountered. *Fukuhara* projects no stripes or other patterns, employs no cameras, and produces no images. Not only is the present claimed invention an improvement over *Abbot-PV*, but the present claimed invention is also an improvement over the sort of system taught in *Fukuhara* for precisely the reasons set forth in the background section of the present specification.

In addition, *Fukuhara* teaches an entirely different approach to the problem from that taught by *Abbot-PV*. If one were to combine the *Fukuhara* technique into *Abbot-PV*, then *Abbot-PV* would cease to accomplish its purpose of measuring distortion, although it may be then able to measure cracks. There would be no motivation for such a combination because *Abbot-PV* does not seek to detect cracks.

Claims 5-9 are allowable for the above-discussed reasons due to their dependency on claim 1. But another reason exists for finding claims 5-9 allowable. Regarding claims 5, and 7-9, the Office Action alleges that *Abbot* discloses producing an image signal and correlating the image signal with a reference signal. This allegation is a mischaracterization of that which *Abbot-PV* teaches. *Abbot-PV* does not correlate signals. Rather *Abbot-PV* merely teaches measuring the longitudinal width of a stripe and comparing this width against a standard (being the width of a

stripe on a perfectly flat surface). Abbot-PV teaches a methodology to detect undulations or waves in a glass plate. These undulations result in reflections of a stripe that vary in width in the longitudinal direction. A concave undulation causes a reduced stripe thickness, and a convex undulation causes an expanded stripe thickness. Measurement, not correlation, is required to detect variation in stripe thickness. Such measurement is not a correlation operation as understood in mathematics and by those skilled in the art.

On page 7 line 18, Abbot-PV states that "[m]aximum and minimum distances are defined and correlated to actual distortion in the glass sheets." This statement indicates that a tolerance zone is defined for the width measurements. It does not teach of "correlating said image signal with a reference signal to produce said profile of said surface", as claimed in applicant's claims 5-6, and similar language in claims 7-9.

In addition, each of applicant's claims 7-9 recite "determining, in response to said correlation signal, a relative height ..." But Abbot-PV makes no effort to determine height. The concern of Abbot-PV is with flatness, not contour.

Furthermore, the Office Action alleges that the only difference between claims 8 and 7 is that claim 8 specifies that partitioning the image into twenty-five image regions and that it would have been obvious to partition the image into any desired number of regions. But Abbot-PV teaches no such partitioning. Any suggestion otherwise comes from subject matter added after the filing of applicant's application.

Accordingly, *Abbot-PV* fails to teach several features recited in applicant's claims 5-9, and independent grounds exists for finding claims 5-9 allowable.

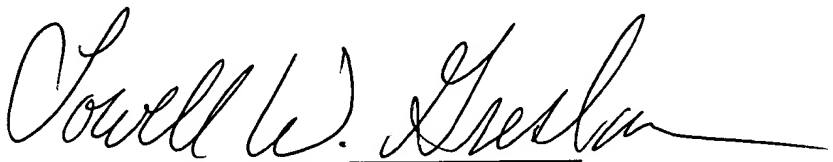
Claims 16-17 are allowable for the above-discussed reasons due to their dependency on claim 11. But another reason also exists for finding claims 16-17 allowable. The Office Action alleges that *Abbot* discloses a projector projecting a pattern having a specific monochromaticity, and a camera filtered to be sensitive to that monochromaticity. But *Abbot-PV* teaches the opposite. *Abbot-PV* says that its light box 15 uses fluorescent light bulbs, which are well-known to provide light over a range of chromaticity, and says nothing about filtering the reflected light. The Office Action further alleges that *Abbot* teaches the use of a laser. This allegation may be true for the published US application, but only to the extent that new subject matter was added after *Abbot-PV*. This teaching is absent from *Abbot-PV* and cannot be used a prior art against the present application. Accordingly, independent grounds exist for finding claims 16-17 allowable.

Claim 18 is allowable for the above-discussed reasons due to its dependency on claim 11. But another reason exists for finding claim 18 allowable. The Office Action alleges that *Abbot* discloses a stroboscopic projector. But *Abbot-PV* actually teaches away from this. *Abbot-PV* teaches the use of high frequency fluorescent lighting with a patterned diffuser. Even high frequency fluorescent lighting does not lend itself to a strobe application, and no structure is taught that would strobe after light generation. To the contrary, *Abbot-PV* expressly states that high frequency fluorescent lighting is used to avoid 60 Hz beating with the camera video rate. In other words, *Abbot-*

PV seeks to avoid stroboscopic effects. Accordingly, independent grounds exist for finding claim 18 allowable.

Applicant believes that the foregoing amendments and remarks are fully responsive to the rejections and objections recited in the 6 May 2004 Office Action and that the present application is now in a condition for allowance. Accordingly, reconsideration of the present application and the issuance of a timely Notice of Allowance are respectfully requested.

Respectfully submitted,

A handwritten signature in cursive script, reading "Lowell W. Gresham", written in dark ink. The signature is fluid and extends to the right with a long horizontal stroke.

Lowell W. Gresham
Attorney for Applicant
Reg. No. 31,165

Lowell W. Gresham
5727 North Seventh Street
Suite 409
Phoenix, AZ 85014
(602) 274-6996